

# Activating Teaching Methods

## 1. Problem-Based Learning

*Learning by Problem Analysis (The pure form developed at Maastricht University)*

In Problem Based Learning the student working groups are in focus. They are used as tool for learning and the meetings in the groups are the main activity in this method. The bearing idea is that the students learn by relating their knowledge to a given problem or case which the teacher prepare. Through dialogue and discussions the students in the groups try to solve the problem by using their previous knowledge and the new knowledge in the curricula in the course. A course typically starts with an initial lecture, which gives an overview of the course and of the learning objectives. Then follows an introduction of the first problem the students are going to work with. The students meet in their groups and work with the problem on the basis of a very structured method, repeated every time the groups meet:

### Seven-Step Problem Based Learning Procedure

**1. Clarify terms & context**

Does everybody completely understand this problem?

**2. Define the problem**

What is the interesting core of this problem in relation to the topic of the course?

**3. Analyse the case**

Brainstorm on what could be explored/looking deeper into in this problem and clarify what we already know

**4. Re-structure the problem**

Get a systematic overview by grouping related ideas and removing not so interesting ideas

**5. Formulate learning objectives**

What do we need to learn in order to understand this problem?

**6. Individual learning**

Each student studies individually towards the learning objectives

**7. Report back to the group at the next meeting**

What have we learnt? Can we understand this problem now?

The group for each meeting elects a chairman and a secretary. A teacher, an assistant or a specially trained older student is always present during the group work as facilitator, observing and listening to the students work. The teachers thereby gets information on whether some major misconceptions are formed or if a group does not function well. Thus they can help the students back on the right track. This is never

done during the structured group meeting where there are supposed to be no, or very little interference from the teacher.

The course continues like this with supportive lectures and other activities arranged by the teacher, providing the students with information to include in their work with the problems. When one problem is done another one is introduced building on the knowledge from the first problem. This way a progression is ensured. Typically the students work on one problem for a week and may meet twice to work but the time range for each problem can be shorter or longer.

Important in PBL is making sure that the students have access to many different sources of information such as lecturers, seminars, library etc. There are reading lists but not one selected textbook with required reading.

Formulating the problems is crucial. The problems combine elements from all topics in the course – i.e. they do not deal with one topic at a time like the chapters of a typical textbook.

*Assessment:* Individual assessment of learning outcome - typical with the triple-jump assessment method which relates to the seven-step procedure:

1. Brainstorm on the assignment
2. Meet and receive feedback from teacher
3. Answer assignment individually

For some examples of how to use PBL in practise you can visit <http://www.udel.edu/pbl/>.

Teacher role
<ul style="list-style-type: none"> <li>Facilitator for the group work and guide to the learning process. Arrange informative lectures and other sources of information. Structure relevant problems and planning for progression towards the learning objectives</li> </ul>
Groups
<ul style="list-style-type: none"> <li>Permanent</li> <li>Large: 6-10 students (8 students are the optimal group size in PBL)</li> </ul>
Cases
<ul style="list-style-type: none"> <li>Can be small: ~ 1 week and building on each other for progression or larger and more complex with longer duration</li> <li>Realistic and interdisciplinary; a description of a phenomenon or a real-world story</li> <li>Need to cover the core elements in the course</li> <li>Very ill-defined and open to brainstorm and elaboration with knowledge</li> </ul>
Students
Learn to learn, and to take responsibility for their learning
Learn to dealing with complex problems
Learn to know about information resources in the subject

## 2. Learning by Projects

### *Project-organised Learning*

With a project-organised curriculum each semester is structured around an interdisciplinary project. When used in a single course the course is planned around a case covering all core elements in the course.

The teacher selects a theme for the course, and each group of students formulate their own project within the theme, or the teacher outlines some project ideas from which each groups can define their project. Here you as a teacher must take the students previous knowledge and experiences into special consideration: How familiar are the students with project-based learning? How much knowledge do they have of the subject? Are they first year students, or are they further into their education?

You also need to consider how to challenges the students in a reasonably way so they think it is fun and motivating to work with the project and develop their knowledge and competences. Still they must be able to come with a good solution and result in the project.

#### Different types of projects

- **Assignment project:** Planned and controlled by teacher – Subject and problem defined by teacher
- **Subject project:** Planned by teacher; controlled by students – Subject outlined by teacher; problem chosen by students
- **Problem project:** Planned and controlled by students - Problem defined by students, and this determines the subject (within the course theme)

The objective is to solve the problem – i.e. the outcome includes a product.

The groups are working independent, doing their own planning and taking charge of their own process. The group has weekly consultation with the teacher, and several times during the process, the group has more formal meeting with the teacher. At these meeting, which must be well prepared by the students, the group gives a status report, identifies current problems and outlines future actions.

Lectures can be given as supplement to the group work and to support the semester theme.

*Assessment:* Outcome and process are assessed on basis of group project report with oral presentation and some kind of individual assessment for individual grading.

Teacher role
Process and group facilitator (tutor) and expert (consultant)
Groups
<ul style="list-style-type: none"> <li>• Permanent</li> <li>• Medium: 4-6 students</li> </ul>
Cases

• Large: ~ 1 course
• A real-life task - Exemplarity: Typical for course subject and suitable for generalisation
• Ill-defined and open
Students
Learn to learn, and to take responsibility for their learning
Learn to dealing with complex problems
Learn to know about information recourses in the subject

### 3. Learning by inquiry

#### *Learning by research*

The aim of this method is to give the students a life-long insight into research as a method to create new knowledge and learn. The method also meets the demands for higher education to be research based and gives the students an understanding of research processes in their field of study.

In inquiry based learning the students are responsible for defining the central parts in the curricula the teacher has chosen as a subject for the course. The students must find, evaluate and use the sources of information available for the subject in question. The students start with one basic question and while they are expanding their knowledge the teacher inspire them to formulate and answer more detailed questions.

Great emphasis is placed on reporting achieved results and documentation of the progress in the students learning. This is done by the students themselves. Evaluation of the results is conducted by the students through self- and peer-assessment. This is a very central part of the method.

#### Steps in inquiry based learning

1. The teacher chooses a theme
2. The students identify learning objectives and formulate relevant research questions
3. The students identify the information sources and how to use them in the best possible way. Consults primary and secondary research information but also do research themselves
4. The students use different sources and resources to get information and they report learning outcome in many different ways (papers, classroom conferences, poster presentations and so on)
5. The students evaluate their learning outcome by using self- and peer-assessment. The teacher is responsible for the grading and final assessment.
6. The students are encouraged to identify new research questions themselves

Assessment: Learning portfolios, reports, and traditional examinations. Focus, while grading, contract fulfilment.

For further information visit those interesting web-pages: [www.inquiry.uiuc.edu](http://www.inquiry.uiuc.edu),  
<http://www.mcmaster.ca/cil/inquiry/inquiry.resources.htm>

Teacher role
<ul style="list-style-type: none"> <li>• Expert and supervisor. Method of interaction; the students are posing questions, dialogue method.</li> </ul>
Groups
<ul style="list-style-type: none"> <li>• Small: 2 to 4 persons or individual work (1 person)</li> </ul>
Cases
<ul style="list-style-type: none"> <li>• Large – 1 course</li> <li>• Real life</li> <li>• Ill-defined and open ended</li> <li>• Research like</li> </ul>
Students
<ul style="list-style-type: none"> <li>• Learn to learn, and to take responsibility for their learning</li> <li>• Learn to dealing with complex problems</li> <li>• Learn to know about information recourses in the subject</li> </ul>

## 4. Spiral Learning

### *Learning by Repetition and Feedback*

The teaching sequence is divided into several (2-4) sections or “windings” in a spiral. In each winding the course subject is approached both from top (overview) and bottom (details).

In the first winding the students are working with the course subject in a very basic way. Elements from all of the course topics are included and a general overview of the course subject is given – i.e. the topics are not dealt with one at a time like the chapters of a typical textbook. The students are given group assignments to solve based on their present knowledge – maybe only in a qualitative way the first time, of course depending on the subject.

In the following windings the students are working with the subject in increasingly advanced ways. It might be the same problem they are given in each winding – but the solution becomes more and more sophisticated and at a higher level of competency. In the last winding the final level of competence (learning objectives) is reached.

It is extremely important when applying this method to provide the students with feedback on their learning progression so they are aware about their present knowledge so they can focus their learning learn more in the next winding.

Some underling ideas for this method you can find here:

<http://tip.psychology.org/bruner.html>

*Assessment:* Progress assessment based on the assignments with feedback and a final assessment.

Teacher role
<ul style="list-style-type: none"> <li>• Expert and tutor</li> </ul>
Groups
<ul style="list-style-type: none"> <li>• Medium: 4-6 participants</li> </ul>
Cases
<ul style="list-style-type: none"> <li>• Constructed with progression</li> <li>• Authentic</li> </ul>
Students
<ul style="list-style-type: none"> <li>• Learn to learn, and learn to take responsibility for their own learning</li> </ul>

## 5. Learning by step-by-step theory application

### *Learning by structured theory application*

The teacher selects one case that covers all the major topics in the curriculum. The case can be based on any topic that suits the course. A case might for instance be technical devices such as a CD-player or a washing machine and the students are supposed to reach an understanding of different engineering aspects of them. It might also be a house or a road where the students are supposed to reach an understanding how to construct them taking different theoretical aspects into account. You must find a case suitably for the course on which the students can apply the theory in course.

The case is divided into weekly group assignments, whose solutions will lead towards the solution of the overall case. It is not to be possible to answer the assignments without knowing the theory of the specific week. The students apply and relate the theory to the case in order to gradually reach a better understanding of it. The theory is easier to understand if it is applied to a concrete device or problem. Seeing how to apply the theory It is also more motivating for the students.

The first assignment gives a general overview of the case. Then the case is gradually divided into blocks that are dealt with and in the end again assembled into a final system or solution. The assignments include both theoretical aspects and practical construction skills.

The students are given written feedback on their answers to the weekly assignment.

**Weekly activities:**

1. A group present its solution to last week's problem
2. Short introduction lectures - mostly concerning the weekly assignment (not deductive teaching); it is basically up to the students themselves to read the necessary theory to solve the problem.
3. Group work in class to discuss the assignment.
4. "After lectures" to generalise the theory that the students have been working with – or on-demand lectures on topics that the students find difficult.
5. Individual work and group work after class to answer the assignment.

*Assessment:* Portfolio assessment based on the handed in and commented weekly assignments and the final product together with other suitable assessment forms.

Teacher role
<ul style="list-style-type: none"> <li>• Expert and tutor</li> </ul>
Groups
<ul style="list-style-type: none"> <li>• Permanent</li> <li>• Medium: 4-6</li> </ul>
Cases
<ul style="list-style-type: none"> <li>• Large: 1 course – but divided into weekly assignments</li> <li>• Authentic but not necessary real-life</li> <li>• Relatively well-defined and closed</li> </ul>
Students
<ul style="list-style-type: none"> <li>• Learn to learn, and to take responsibility for their learning</li> <li>• Learn to dealing with complex problems</li> </ul>

## 6. Flexible Learning and E-learning

### *Learning for Student Diversity*

Flexible learning expands choice on what, when, where, and how people learn. It supports different learning styles and different living conditions that the students may have. This way of organising university teaching goes far beyond the traditional way of thinking about teaching and learning. E-learning is a tool often used in flexible learning because of its independence of time and place. Flexible learning and use of E-learning is often associated with distance learning but the underlying ideas can also be used in campus courses to improve them in various ways. Many of the ideas on which flexible learning is based really support student learning in an efficient way.

#### Flexible learning

- Is based on the needs of the students
- Gives students as much control as possible of what, when, where, and how they learn and study
- Makes use of the methods most useful for the students - especially e-learning

Emphasis is on meeting students needs, recognising that all learners has unique, complex needs, and this method gives learners greater influence on what they need to learn, where, when and how.

The method provides greater flexibility for learners *where* and *when* to study: mixing and matching on-campus teaching and distant learning (workplace and home), and offering more flexible forms of access, entry and exit.

It is also possible to obtain a greater variety for learners in the *how* to study: especially through the use of self-instructional learning resources and online technologies, independent or based on group work. Many teachers who use flexible learning develop computer based learning modules so the students can construct their own curriculum based on previous knowledge and the levels of the goals that the students set up for the course. Some might only need an overall introduction to an area of the subject, while other students want to go in depth in the course because the subject is a part of their main competence profile. Using flexible learning the teacher can more easily meet the demands in teaching inhomogeneous groups of students.

A well known method which apply the web and computers in a structured way in campus courses is “Just-in-time-teaching” (JiTT). For more information see <http://jittl.physics.iupui.edu/jitt/>.

*Assessment:* Very often On-line test but more traditional assessment methods can be used depending on the context in the course.

Teacher role
• Enabler of student learning and consultant
Groups
• Various group sizes. Meeting in real or/and virtual.
Cases
• Flexible
• Authentic
Students
• Learn to learn, and take responsibility for their learning

## 7. Learning with Cases

### *Discussion-based Learning*

Class-room teaching with dialogue

Teaching with cases is a very suitably method to use when lectures are the main teaching form in a course. It contributes to activating the students by having them working with small problems/cases in a structured way. Thereby they are made to use their knowledge in the field of subject actively and also actively work with the present course content. The method is developed at Harvard Business School and it is very famous.

The procedure follows a **three-stage learning process**



Before class the students are given a case to read and analyse as preparation.

1. Individual preparation of the case

In class the case-work follows the procedure:

2. Small-group (2-4 students) discussion to sum up their knowledge and come to some conclusions about the case
3. Class discussion on the case lead by the teacher

One main activity during the lectures, which is extremely important, is that the teacher sum up the conclusions in the end of if. Most probably there have been a lot of discussions and suggestions from the groups and it is important to tie all the loose ends together.

In this method the construction and formulation of the cases are important. They must cover the topics for the lecture and they must provide a suitable challenge for the students. It can be a real life problem or a constructed task the students must work with and discuss.

A tool for the teacher is the **case difficulty cube**. In accordance with the principles of this model, the cases become increasingly complex during the course:

## Analytical dimension

Degree 1: Problem and decision given

Degree 2: Only problem given

Degree 3: No problem

## Conceptual dimension

Degree 1: One simple theory

Degree 2: Multiple simple or one complex

Degree 3: Multiple complex theories

## Presentation dimension

Degree 1: Short & Well-organised: All data given - No extra data

Degree 3: Long & Unorganised: Relevant data missing - Extra data given

*Assessment:* Individual oral examination and very often an individual final assessment in the end of the course. (A myth about this method is that skilled teachers in teaching with cases can assess the students individually during the class room discussions)

You can read more about how to use this method at

<http://tlt.its.psu.edu/suggestions/cases/casewhat.html>

Teacher role
• Expert and facilitator of the class discussions
Groups

## UDTU

<ul style="list-style-type: none"><li>• From individual over small-groups (~2 students or more) to all class</li></ul>
Cases
<ul style="list-style-type: none"><li>• Very short and depending on the structure of the course. Typically one per lecture.</li></ul>
<ul style="list-style-type: none"><li>• Real-world problem</li></ul>
<ul style="list-style-type: none"><li>• Well-defined with lots of data but open</li></ul>
Students
<ul style="list-style-type: none"><li>• Learn to deal with complex problems</li></ul>